PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-148833
(43)Date of publication of application : 02.06.1999

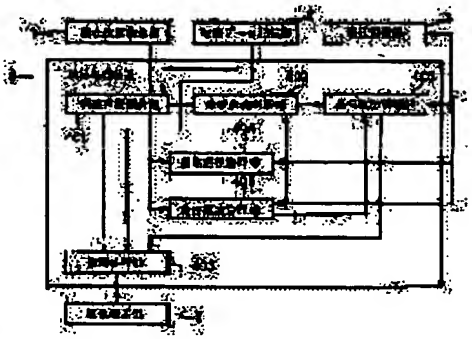
(51)Int.Cl. G01C 21/00
G08G 1/0969
G09B 29/10

(21)Application number : 09-313841
(22)Date of filing : 14.11.1997

(71)Applicant : NISSAN MOTOR CO LTD
(72)Inventor : WATABE MASAYUKI
SAITO HIROSHI
ONO TAKESHI
KISHI NORIMASA

(54) NAVIGATION SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To automatically store a course less familiar to a user for displaying with a course guide.
SOLUTION: Related to the navigation system, a current position collating part 401 collates a car's current position to a current position on a map data read from a map data storage part 2, and a separating/joining judging part 402 compares a current position collated currently to a current position collated previously, to judge whether the car has separated from a truck road of a pre-specified level or above or has joined to it. Based on the judging result, a run path managing part 404 stores a series of current positions changing from branching from a trunk road to re-confluence as a run path in a history storage part 3. Then a drawing process part 406 decides a map region to be displayed according to a current position at a current time, draws a map image on a map display part 5 based on a map data read out of the current position collating part 401, and displays a part or all of the run path stored in the history storage part 3 on the map image as a distinctive form.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A present position detection means which positions a current position of vehicles characterized by comprising the following, A navigation system provided with a map data memory measure which memorizes map data, a history storage means memorized in a form which can update a run history, an arithmetic processing means which performs data processing required for a map display, and an image display means which displays a map image.
A current position collation means which compares a current position on map data which read said arithmetic processing means from said map data memory measure based on an output of said present position detection means.
A branching unification decision means which judges whether it branched from a trunk road beyond a scale which compared this compared current position with a current position compared with the actual making of the tea temporarily, and as which a traveling vehicle was determined beforehand, or this was joined.
A running-locus management tool memorized to said history storage means by making into a running locus a series of current positions which change from branching to unification according to a decision result of this branching unification.
A drawing processing means which displays a part or all of a running locus that determined a map area displayed according to a current position at present, drew a map image based on map data which said current position collation means began to read, and was memorized by said history storage means in a form discriminable to this map image.

[Claim 2]In the navigation system according to claim 1, said arithmetic processing means, A navigation system, wherein it has a road scale management tool which memorizes total mileage for every road scale, or its ratio to said history storage means and said branching unification decision means sets up a definition of a trunk road used as a decision criterion of said branching unification based on a run ratio for every road scale concerned.
[Claim 3]Memorize said road scale management tool to said history storage means for every partition region appointed beforehand, and total mileage for every road scale, or its ratio said branching unification decision means, The navigation system according to claim 2 defining independently a definition of a trunk road used as a decision criterion of said branching unification for said every partition region, and setting up based on a run ratio for every road scale of this.
[Claim 4]In the navigation system according to any one of claims 1 to 3, said arithmetic processing means, Have a run frequency management tool which memorizes run frequency for every road to said history storage means, and said branching unification decision means, A navigation system regarding it as a trunk road and using for a decision criterion of said branching unification if the run frequency is high beyond a predetermined value even if it is a road which does not correspond to said trunk road.
[Claim 5]The navigation system according to claim 4 if the run frequency becomes the history storage means concerned to a once memorized running locus with reference to said run frequency memorized by said history storage means beyond a predetermined value, wherein said running-locus management tool will delete memory of the running locus concerned.
[Claim 6]The navigation system according to any one of claims 1 to 5 performing memory of said running

locus, frequency memory, or memory deletion in a road link unit which constitutes said running locus.
[Claim 7]The navigation system according to any one of claims 1 to 5 making even a re-juncture from a turning point from said trunk road to said trunk road into one course, and performing memory of said running locus, frequency memory, or memory deletion in the course unit concerned.
[Claim 8]When said drawing processing means approaches either of said running loci current positions of vehicles were remembered to be by said history storage means, When one terminal point of the running loci concerned is approached, or when it arrives at the parallel running section concerned in either of said running loci, and said trunk road to run parallel to, The navigation system according to any one of claims 1 to 7 displaying one of the applicable running loci in a form where it is discriminable on a map image.
[Claim 9]The navigation system according to any one of claims 1 to 7, wherein said drawing processing means displays all the running loci that exist in a specific field near a current position of vehicles among said running loci memorized by said history storage means in a form where it is discriminable on a map image.
[Claim 10]When said drawing processing means draws a map image based on map data which said current position collation means began to read, The navigation system according to any one of claims 1 to 9 displaying said running locus on a position applicable even if it is a road which is not included in the map image data concerned compulsorily.
[Claim 11]The navigation system according to any one of claims 1 to 10, wherein it changes said drawing processing means into a display attribute to which it is given by road scale of a higher rank and it displays said running locus rather than the original road scale on said map image.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]In the navigation system which displays the current position of vehicles with a map image and with which uses, such as a course guidance, are presented, this invention relates to the navigation system which has a function which memorizes a running path automatically and displays it especially.
[0002]
[Description of the Prior Art]As a conventional navigation system, there are many things which have a function of vehicles which sometimes memorizes the current position of **** as sequence-of-points data, and is displayed as a running locus. If it is in such a navigation system, memorize all the position data unconditionally, but. Since it had composition deleted from the past data one by one when fixed data volume was exceeded from restrictions of the storage capacity, the course to not necessarily carry out an user validation is always memorized, and it is not said if needed that it can be referred to.
[0003]If it is shown in the "running-locus display" indicated by JP,6-300577,A in order to solve this, saving a desired running locus by a user's request input at memory storage different from the present running locus is indicated.
[0004]
[Problem(s) to be Solved by the Invention]However, since the user's alter operation is made into the opportunity of running-locus memory in this conventional example, While there is an advantage with which it can be thoroughly satisfied a user's course memory demand, the troublesomeness which a user has to operate is left behind in detail, When the interface that operation of this running-locus memory follows a hierarchical menu especially realized, there was troublesomeness which must make it have to stop and must operate vehicles on [of operation] safe each time. When the user had forgotten the alter operation of the recording request, there was also a problem that the running locus to need was not memorized.
[0005]By the way, if the big course of convenience is simple and it is easy to memorize it in the course the user ran in the past, it will be thought that the necessity that a system memorizes automatically is low, the course it is hard for a user to memorize is memorized automatically, and to be reflected in a course guidance is desired. That is, since it will be assumed that it is difficult for the user itself to have memorized such a course if a road scale is small and complicated, and if the frequency which runs the area is low, what it identifies automatically and is memorized by the system side about such a course is desired. Since the user will pass through such a course repeatedly if run frequency becomes to some extent high even if a road scale is small and complicated, It can assume that the necessity of the user having already memorized and carrying out a course guidance is lost, and even if it is the once memorized running path, about such a course, a limited memory is effectively utilizable by deleting from memory.
[0006]This invention by having been made in view of such a conventional problem, and performing start of running-locus memory, and closing automatically ignited by the objective criterion which reflects a user's essential course memory demand to some extent, Without requiring memory demand operation of a running locus of a user, the probability which needs memory according to a user's operating characteristic memorizes automatically about a high running locus, and aims at providing the navigation

system which can be used for a course guidance.
[0007]
[Means for Solving the Problem]A present position detection means in which an invention of claim 1 positions a current position of vehicles, A map data memory measure which memorizes map data, and a history storage means memorized in a form which can update a run history, It is a navigation system provided with an arithmetic processing means which performs data processing required for a map display, and an image display means which displays a map image, A current position collation means which compares a current position on map data which said arithmetic processing means read from said map data memory measure based on an output of said present position detection means, A branching unification decision means which judges whether it branched from a trunk road beyond a scale which compared this compared current position with a current position compared with the actual making of the tea temporarily, and as which a traveling vehicle was determined beforehand, or this was joined, A running-locus management tool memorized to said history storage means from branching to unification according to a decision result of this branching unification by making a series of changing current positions into a running locus, A map area displayed according to a current position at present is determined, a map image is drawn based on map data which said current position collation means began to read, and it has a drawing processing means which displays a part or all of a running locus that was memorized by said history storage means in a form discriminable to this map image.
[0008]In a navigation system of an invention of claim 1, a present position detection means detects a current position of self-vehicles periodically, and it compares with a current position on map data which read this current position from a map data memory measure by a current position collation means. And a branching unification decision means compares a current position compared at present and a current position compared with the actual making of the tea temporarily, . [whether it branched from a trunk road beyond a scale as which self-vehicles were determined beforehand, and] Or it judges whether this was joined, a running-locus management tool makes a running locus a series of current positions which change until it results in re-unification to a trunk road from branching from a trunk road according to a decision result of this branching unification, and it memorizes to a history storage means. And a drawing processing means determines a map area displayed according to a current position at present, based on map data which a current position collation means began to read, a map image is drawn to a map display means, and a part or all of a running locus that was memorized by history storage means is displayed in a form where it is discriminable on this map image.
[0009]When it runs a non-trunk road which a user cannot memorize easily as a running path by this, the course is memorized automatically, corresponding to a current position of self-vehicles, a user does not have familiarity in the case of a course-guidance display, and, so, a high course of the necessity for a display can be displayed with a map image.
[0010]In the navigation system according to claim 1 an invention of claim 2, Said arithmetic processing means has a road scale management tool which memorizes total mileage for every road scale, or its ratio to said history storage means, Said branching unification decision means sets up a definition of a trunk road used as a decision criterion of said branching unification based on a run ratio for every road scale concerned, The total mileage is memorized for mileage of a road which ran [way / a speed way, a national highway, / district] a definition of a trunk road for every road scale, and only the course is memorized based on a ratio of total mileage for every road scale over a total mileage by making into a non-trunk road a small-scale road where a run ratio is low.
[0011]Since a run ratio rises even if it is not a minor road, if it is a road which runs frequently by this according to a user's running characteristic, it is regarded as a trunk road, It dares to be made to carry out the route display of such a course to a user, it memorizes a running locus only about a course with little familiarity for a user, and displays it for a course guidance.
[0012]An invention of claim 3 memorizes total mileage for every road scale, or its ratio to said history storage means in a navigation system of claim 2 for every partition region where said road scale management tool was defined beforehand, A definition of a trunk road where said branching unification decision means serves as a decision criterion of said branching unification is independently defined for said every partition region, Since a big difference comes out in a user's memory even if a scale of a road it ran in a zone is set up based on a run ratio for every road scale of this, and a user runs daily, and a zone it runs in the case of a trip is the same, A running locus is memorized only about a course with

little familiarity, and it is made to display for a user also in a user's life area also in a distant area for a course guidance by defining a definition of a trunk road independently for every partition region in a zone it runs daily, and the other zone.

[0013]In the navigation system according to any one of claims 1 to 3 an invention of claim 4, Said arithmetic processing means has a run frequency management tool which memorizes run frequency for every road to said history storage means, If the run frequency is high beyond a predetermined value even if said branching unification decision means is a road which does not correspond to said trunk road, will regard it as a trunk road and it will be made to use for a decision criterion of said branching unification, About a course expected that a possibility that a user is running repeatedly, is going to memorize positively and refer to it next time at the time of a run even if a road scale is small is low. When saving storage capacity and displaying a memory course by not memorizing this, complicatedness is avoided by not displaying an unnecessary course.

[0014]In a navigation system of a statement of claim 4 an invention of claim 5, Said run frequency where said running-locus management tool is memorized by said history storage means is referred to, If the run frequency becomes the history storage means concerned to a once memorized running locus beyond a predetermined value, memory of the running locus concerned will be deleted, Even if it is the once memorized course, when saving storage capacity of a running locus by deleting from memory about a course so that it may be assumed that a user memorized by running several times and displaying a memory course, complicatedness is avoided by not displaying an unnecessary course.

[0015]In a navigation system of claims 1-5 an invention of claim 6, Memory of said running locus, frequency memory, or memory deletion is performed in a road link unit which constitutes said running locus, storage and file management of a course can be uniformly performed per minimal-basis book which constitutes road data, each data processing becomes simple, and improvement in processing speed can be desired.

[0016]In a navigation system of claims 1-5 an invention of claim 7, Memory of said running locus, frequency memory, or memory deletion is made into one course even for a re-juncture from a turning point from said trunk road to said trunk road, About a course which includes a road link which is common even if it carries out in the course unit concerned and is alternative pathway as a detour. If storage and file management is carried out per road link, a ratio of total mileage will rise, If run frequency is low as the whole course also about a road link which run frequency becomes high, and is defined as a trunk road, and becomes non-display in the case of a route display, or is deleted from memory, it will be displayed as a part of course, and a route display adapted to a user's feeling becomes possible.

[0017]In a navigation system of claims 1-7 an invention of claim 8, When said drawing processing means approaches either of said running loci current positions of vehicles were remembered to be by said history storage means, When one terminal point of the running loci concerned is approached, or when it arrives at the parallel running section concerned in either of said running loci, and said trunk road to run parallel to, It enables it to display one of the applicable running loci in a form where it is discriminable on a map image, only a required course can be displayed only within a case where it is expected that the necessity that a user refers to it is high, and complicatedness of a display can be avoided.

[0018]In a navigation system of claims 1-7 an invention of claim 9, Inside of said running locus said drawing processing means was remembered to be by said history storage means, All the running loci that exist in a specific field near a current position of vehicles are displayed in a form where it is discriminable on a map image, Only a high course of the necessity of being near the self-vehicle position, therefore referring to it can be displayed without performing complicated data processing of calculating distance of self-vehicles and each running locus.

[0019]In a navigation system of claims 1-9 an invention of claim 10, When said drawing processing means draws a map image based on map data which said current position collation means began to read, Said running locus is compulsorily displayed on a position applicable even if it is a road which is not included in the map image data concerned, For example, even if it is a case where it will not be displayed if the running locus concerned and a small-scale road below equivalent are original, since map display mode is during self-vehicle running or is a broader-based display, a high course of the necessity of referring to it for a user is always displayed by displaying this.

[0020]In a navigation system of claims 1-10 an invention of claim 11, A display which said drawing

processing means changes said running locus into a display attribute to which it is given by road scale of a higher rank, displays it rather than the original road scale on said map image, and is easy to understand to a user as a road map display is possible.

[0021]

[Effect of the Invention]When it runs the non-trunk road which a user cannot memorize easily as a running path according to the invention of claim 1, memorize the course automatically, and it corresponds to the current position of self-vehicles in the case of a course-guidance display, A user does not have familiarity and, so, the high course of the necessity for a display can be displayed with a map image.

[0022]Since a run ratio rises even if it is not a minor road, if it is a road which runs frequently according to a user's running characteristic according to the invention of claim 2, it is regarded as a trunk road, it prevents from the route display of such a course daring to be carried out to a user, it can memorize a running locus only about a course with little familiarity for a user, and can display it for a course guidance.

[0023]When a user defines the definition of a trunk road independently for every partition region in the zone it runs daily, and the other zone according to the invention of claim 3, Also in a user's life area, for a user, a running locus can be memorized only about a course with little familiarity, and it can display also in a distant area for a course guidance.

[0024]According to the invention of claim 4, even if a road scale is small, the user is running repeatedly, When the course expected that a possibility of it memorizing positively and referring to it next time at the time of a run is low saves storage capacity and displays a memory course by not memorizing, it can avoid complicatedness by not displaying an unnecessary course.

[0025]So that it may be assumed that the user remembers by according to the invention of claim 5 running several times even if it is the once memorized course about a course. When saving the storage capacity of a running locus and displaying a memory course by deleting from memory, complicatedness can be avoided by not displaying an unnecessary course.

[0026]According to the invention of claim 6, storage and file management of a course can be uniformly performed per minimal-basis book which constitutes road data, each data processing becomes simple, and processing speed can be improved.

[0027]According to the invention of claim 7, about a course which includes the road link which is common even if it is alternative pathway as a detour. If storage and file management is carried out per road link, the ratio of total mileage will rise, If run frequency is low as the whole course also about a road link which run frequency becomes high, and is defined as a trunk road, and becomes non-display in the case of a route display, or is deleted from memory, it can display as a part of course, and the route display adapted to the user's feeling is possible.

[0028]According to the invention of claim 8, only a required course can be displayed only within the case where it is expected that the necessity that a user refers to it is high, and the complicatedness of a display can be avoided.

[0029]According to the invention of claim 9, only the high course of the necessity of being near the self-vehicle position, therefore referring to it can be displayed, without performing complicated data processing of calculating the distance of self-vehicles and each running locus.

[0030]According to the invention of claim 10, even if it is a running path belonging to the small-scale road which will not be displayed by map display mode if it is original, the high course of the necessity of referring to it for a user can be displayed by displaying this.

[0031]According to the invention of claim 11, since a running locus is changed into the display attribute to which it is given by the road scale of the higher rank and is displayed rather than the original road scale on a map image, the display which is easy to understand to a user as a road map display is possible.

[0032]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is explained in full detail based on a figure. Drawing 1 shows the composition of the processing capability of the navigation system of a 1st embodiment of this invention, and the navigation system of this embodiment comprises the following: The current position primary detecting element 1 which positions the current position of vehicles. The map data storing section 2 which memorizes map data.

The history storage part 3 memorized in the form which can update run histories, such as a locus, mileage, and run frequency.
The arithmetic processing unit 4 which performs data processing required for a map display, and the picture display part 5 which displays a map image.

[0033]The current position primary detecting element 1 measures the current position of a traveling vehicle in the form of lat/long etc. with GPS, a speed sensor, a gyro sensor, etc., for example, and outputs. Although the map data storing section 2 and the history storage parts 3 may be storages, such as CD, DVD, a flash memory, and it may be one constitutionally, at least about history memory, renewal of memory contents, such as writing and deletion, must be possible. The arithmetic processing unit 4 is a computer which comprises CPU, an internal memory, etc., and memorizes and performs various processing in the form of a program. The picture display parts 5 are displays, such as a liquid crystal display monitor and CRT.
[0034]If the arithmetic processing unit 4 is divided into a functional order and shown, based on the output of the current position primary detecting element 1, The current position collating part 401 which compares and pinpoints the current position of vehicles on map data using techniques, such as map matching, and the compared current position are compared with the current position compared with the actual making of the tea temporarily, . [whether it branched from the road (trunk road) beyond the scale as which the traveling vehicle was determined, and] Or it memorizes to the history storage part 3 by making into a running locus a series of current positions from branching to unification according to the decision result of the branching unification judgment part 402 which judges whether it was joined, and the branching unification judgment part 402, Or if needed this. The road scale Management Department 404 which memorizes the running-locus Management Department 403 which deletes, the total mileage for every road scale, or its ratio to the history storage part 3, the run frequency Management Department 405 which memorizes the run frequency for every road to the history storage part 3, and the map area displayed from the current position of vehicles are determined, A map image is drawn using required map data, and it comprises the drawing processing part 406 which displays a further predetermined running locus.
[0035]When considering it as simple functional constitution rather than not performing change processing of the trunk road decision criterion mentioned later, and storage-and-file-management processing of the running locus by run frequency, the road scale Management Department 404 and the run frequency Management Department 405 can omit.
[0036]Next, operation of the navigation system of a 1st embodiment of the above-mentioned composition is explained. The flow of processing is shown after a current position is updated until a map screen is displayed, In this embodiment, unless the processing of those other than a map display applies interruption, repeat execution of this processing is carried out, and it carries out the thing of drawing 2 and drawing 3.
[0037]The current position collating part 401 reads map data required for subsequent processings from the map data storing section 3 based on the currency information which the current position primary detecting element 1 outputs first. If the processing repeated last time is also used and some or all of required data is already saved inside on the occasion of reading, it is not necessary to read anew including an overlapped part (Step S1).
[0038]The current position collating part 401 compares the current position of vehicles succeedingly on the map data read in the preceding paragraph using techniques, such as map matching, It is specified as each link which road link top in this data self-vehicles are running now by the identifier in which it was provided by the meaning (Step S2). Henceforth [the link specified here] "Ln" will be written. In the last repetition processing, the link similarly specified as a current position at that time shall be referred to by "Lo" so that latter Step S14 may explain. However, when Lo is undecided in the first time, suppose that it is the same as that of Ln.
[0039]Next, the branching unification judgment part 402 judges whether it is the same as compared with the link Lo specified by the last repetition in the link Ln specified in the preceding paragraph. When the migration length of self-vehicles is short, or the link concerned is long and Lo and Ln are the same, memory of a running locus is not updated but it shifts from it to drawing processing of Step S13 (Step S3).

[0040]When Lo differs from Ln in judgment of this step S3, the road scale Management Department 404 updates the mileage for every road scale on the history storage part 3 (step S4).
[0041]Here, a road scale shall be an index used for the judgment of "whether to be a trunk road" mentioned later, and it shall set with the classification of roads, such as a highway, a national highway, and a prefectural road, and width in this embodiment. Such classification and width are described about each road link of each in map data. And the field which memorizes the total traveled distance data for every [as shown in drawing 4] road scale is established in the history storage part 3. This drawing 4 shows independently the example which memorizes the data in which the ratio of those mileage to the mileage and the total mileage for every road scale is shown about classification and width, respectively.
[0042]However, the traveled distance data for every road scale is not what is restricted to this data format, For example, it may be made to memorize only the total traveled distance data for every road scale or the total mileage, and the run ratio data for every road scale, and another side can be immediately computed from one side in that case if needed. Judgment of the "trunk road" mentioned later should be memorized only about which or a required index, if only a road class shall be judged only by the width of street. Or combining classification and width, road scale classification may be defined in a form like "a with a width [6-10m] principal prefectural road" and "a national highway with a width of less than 3 m", and total mileage may be memorized for every classification of the. However, it is necessary to define beforehand be [which road scale / large] it considers in the form where a part for the whole division is put in order by one row, in this case at the size relation of a road scale during each classification, for example, "a with a width [6-10m] principal prefectural road" and "a national highway with a width of less than 3 m."
[0043]The case where Lo differs from Ln branches to "NO" at the above-mentioned step S3, progresses to step S4, and this, I hear that it newly moved to another link Ln from Lo, and it is, and since it may think that mileage increased a part for the length of the link Lo certainly, in step S4, total mileage is updated based on this Lo. For example, if Lo is a principal prefectural road which is the width 6-10m, the length of Lo will be applied to a "principal prefectural road", the "width 6-10m", and the "total mileage", respectively. Since the total mileage is updated, it will re-calculate about the ratio of each classification.
[0044]The run frequency Management Department 405 updates the run frequency of Ln on the history storage part 3 after renewal of this run history data (Step S5). The field which memorizes the run frequency about all the road links as shown in drawing 5 is established in the history storage part 3. Since self-vehicles newly progressed to Ln, "1" increment of the frequency of the link identifier equivalent to this road link Ln is carried out.
[0045]Then, the branching unification judgment part 402 judges whether the present road link Ln is a trunk road (Step S6). Here, a "trunk road" refers to the road the above-mentioned road class, the width of street, or whose road scale that becomes settled with both combination is above a certain fixed standard. The constant thing as which this decision criterion was determined beforehand (beforehand) the identifier of whether to be a trunk road is added for every road link, and it judges based on it — it may be — the road scale Management Department 404 and the run frequency Management Department 405 can omit now in that case. However, it is made to change here according to the total mileage for every road scale memorized by the above-mentioned road scale Management Department 404. For example, the numerical standard of "making into a trunk road the road of the scale which shows less than 60% of the total mileage" is established, this is applied to the historical data of the run history storage parts store 3, and the "trunk road" in each time is determined.
[0046]It is as follows when this standard is applied to the historical data of drawing 4. About a road class, the sum total of a speed way and a national highway is 48.3% of the whole, and if a principal prefectural road is added to this, in order to exceed 60%, it is considered that more than a national highway is a trunk road in this case. Since it will exceed 60% if the not less than 6-m sum total is 59.9% and 3-6m are added about the width of street, let width of not less than 6 m be a trunk road. And both logical product is taken eventually and it determines as a trunk road "high-speed Michimata with a width of not less than 6 m is a national highway."
[0047]The determination technique of of this "trunk road" is not limited to this, and logical sum can also determine it instead of taking the logical product of above-mentioned road class conditions and width conditions. It is also possible by memorizing further the total mileage for such every road scale

according to area classification, and establishing a different standard for every present movement area to determine the standard according to a different run mode for every area of a user. For example, the running locus below the "appointed municipal road" is memorized automatically selectively, and when you travel by area classification corresponding to a user's daily living area far away, by it, the technique of memorizing the running locus below a "national highway" automatically selectively can be taken. Anyway, the standard which corresponds to the mode each user usually runs flexibly can be determined by changing the decision criterion of a trunk road according to a run history in this way.

[0048]This road link Ln is especially a road which is easy to memorize for a user, and since it is not necessary to carry out a course guidance by a system, memory processing of being judged as a "trunk road" at this step S6 is not carried out as a running locus. Then, it shifts to Step S7 and the road scale Management Department 404 updates the standard of a road scale of being used for judgment of a "trunk road" if needed.

[0049]As mentioned above, the road link Ln shall make a judgment of being a trunk road based on the total mileage for every road scale memorized on the history storage part 3, but. The decision criterion of the trunk road determined with reference to memory of this history storage part 3 based on the memory concerned whenever it performed the judging process is held to another storage area, and it may be made to make the above-mentioned judgment in accordance with that held standard. For example, when self-vehicles branch from a trunk road and are running the non-trunk road of a comparatively long distance, in spite of making this course into a running locus and having begun to memorize it for every link at the beginning [branched], By updating a decision criterion in the middle of a course under the influence of the total mileage for every road scale updated simultaneously, it is for avoiding the fault that it comes to be considered that the scale of the course concerned is a trunk road, and course memory is interrupted. For that purpose, it must be updated only when it is guaranteed that course memory is not continuing in the decision criterion held to another field. Then, when it is considered in Step S6 as for Step S7 that Ln is a trunk road, Or even if it is not a trunk road so that it may mention later, when run frequency is high and does not serve as a storage object, it performs only within the case where it has already memorized as a running locus, and the decision criterion saved to another field with reference to memory of the total mileage for every road scale is updated.

[0050]When the present road link Ln is judged not to be a trunk road at Step S6 next, the branching unification judgment part 402 investigates whether it is beyond the constant value N as which the run frequency of the road link Ln was determined beforehand (Step S8). Even if this is a small-scale road it is not considered that is a trunk road, it is for saving the amount of stored data by avoiding memorizing this about the course in which run frequency is expected that the user already has full knowledge highly. For this reason, the above-mentioned run frequency Management Department 405 investigates the run frequency of Ln with reference to the run frequency for every road link memorized on the history storage part 3.

[0051]Then, if the run frequency of Ln is more than N, a user will assume that he remembers the course which already contains Ln, If whether the road link Ln is memorized by the history storage part 3 investigates (step S9), and the running-locus Management Department 403 memorizes, and the memory is deleted (Step S10) and it does not memorize, Processing is moved to renewal of the trunk road decision criterion of already explained Step S7, without updating running-locus memory.

[0052]The field which memorizes a running locus shall be established in this history storage part 3, and each road link which constitutes a running locus shall be memorized in enumeration regardless of that connecting relation there. However, if it memorizes with the gestalt which carried out grouping according to the form of a link identifier as shown in drawing 6 for example, when checking whether the given road link Ln exists during this running-locus memory, it becomes unnecessary to carry out full search and a processing load can be reduced.

[0053]By judgment of Step S8, when the run frequency of Ln has not reached the constant value N, it shifts to the processing which memorizes this as a running locus. However, so that the run frequency of the course concerned should already be memorized by the run history part 3 when it passes along this link Ln first, may overlap in such a case and may not be memorized, when saying that it is not the first, although there is, [little] It investigates whether the running-locus Management Department 403 is already ending with memory about the link Ln (Step S11), and If it is ending with memory, it will shift to processing of Step S7, and will memorize as a running locus to the run history storage parts store 3 only

within the case where that is not right (Step S12).
[0054]Here, even if the judging process of Step S11 does not search for whether Ln exists on running-locus memory in detail, it can also be judged [first / which passing through whether it comes out and Ln which run frequency will lend one more simply will lend] by whether it comes out. However, it is better to have considered that the link Ln was a trunk road, when it passed first, but to search for running-locus memory, in order to process certainly since the decision criterion of a trunk road is updated and it may have become a non-trunk road after that.
[0055]After the above conditions' performing deletion from memory of a running locus, and memory or updating the decision criterion of a trunk road, map drawing and route display processing are performed (Step S13). In this processing step S13, in order to display a map image about a predetermined field, drawing processing of map data in which the drawing processing part 406 was given is performed. The road link memorized as a running locus is displayed.
[0056]Change a foreground color or thickness of a line is made thick, or in displaying a map in bird's-eye view form, as offset was attached to the height of an applicable link and it has come up from the map flat surface, it displays on this, for example, The display attribute of a color, thickness, or the amount of displacement can be changed, and highlighting can be performed. When changing and displaying a foreground color especially, it can change and display on the display attribute of the road scale of a higher rank so that the running locus which is a minor street may be displayed with the color and thickness to which it was given by the national highway link. When it is during vehicle running or the broader-based figure is being displayed, a road scale is not caused how but the link memorized as a running locus can be displayed as mode ** as which a small-scale road like a minor street is not displayed.
[0057]Although the display and highlighting of a running locus which were mentioned above may be performed in a displaying object field about all the links memorized as a running locus at each time, it may be made to display, whenever it approached to the defined distance which has a self-vehicle position to the locus concerned. By classifying the map area beforehand, also giving the information on to which of these partition regions each running locus belongs collectively for example, and displaying all the running loci in the field near the self-vehicle position, The same display effect as the above-mentioned approach display can be acquired without performing complicated distance calculation one by one.
[0058]It is stored in Lo after map drawing of Step S13, and route display processing for the reference at the time of next repetition processing of the present road link Ln. And if the same processing is continued further, it will return to Step S1 again, and the processing mentioned above will be repeated (Step S14).
[0059]Drawing 7 shows map drawing pass the above-mentioned processing, and the example of a route display. In this display example, Rm is a trunk road, and Rs is a road smaller than the trunk road Rm, it branches from the trunk road Rm at the point A, and assumes that the trunk road Rm is joined again at the point B. Now, a user branches from the trunk road Rm at the point A, and advances into the alley way Rs, When it runs the course which joins the trunk road Rm again at the point B, since the road scale is large about the trunk road Rm, it does not memorize as a running locus, but if it carries out by having memorized about the alley way Rs which reaches the point A - the point B, the display of the form emphasized as numerals Rs' showed to drawing 7 will be added. If the same user runs such an alley way Rs many times and run frequency becomes high, the data of this alley way Rs will be deleted from running-locus memory, and highlighting Rs' will not be performed, either.
[0060]Thus, in the navigation system of a 1st embodiment. Since it is expected that the user remembers well a major arterial road like a speed way and a national highway, the necessity of carrying out a course guidance is low, but since it is hard for a user to memorize the small-scale road where run frequency is low, If it runs the course, it enables it to use for the course guidance at the time of a next run by memorizing a running locus automatically.
[0061]If run frequency becomes high even if it is a small-scale road, even if it will make a storage capacity small by assuming that the user memorized the course and deleting from running-locus memory, a course guidance can be received about a course very required for a user.
[0062]Next, the navigation system of a 2nd embodiment of this invention is explained based on drawing 8 - drawing 13. Although it memorizes in the form where the road link data which constitutes each

course for a running locus from a 1st embodiment simply is enumerated and was made to carry out independently for every road link also about deletion of memory, According to a 2nd embodiment, it considers that from branching from a trunk road to unification is one distance, and this is memorized as an object unit of storage and file management, and it deletes from memory. The functional composition of the navigation system of a 2nd embodiment is shown in drawing 1 like a 1st embodiment, and since the storage configurations of a running locus only differ, the difference is explained hereafter.

[0063]The flow chart of drawing 8 – drawing 10 shows the flow of processings, such as course memory of the navigation system of a 2nd embodiment, and a map display. Fundamentally, as well as a 1st embodiment, a current position is compared, the road scale of a corresponding road link is investigated, memory of a running locus and deletion are performed, referring to the past historical data if needed, and the processing which displays the course memorized with the map is repeated.

[0064]When the link Lo compared with the beginning included in processing by the last repetition processing is an undefined, the branching unification judgment part 402 sets to Lo the link of the road scale it is considered as a straw man that is a trunk road (Step S21). If this is, for example immediately after a system switches on a power supply, in processing of latter course memory, it is for making it operate so that course memory may be started, if the road link Ln under present run is not a trunk road regardless of Lo. When the dummy trunk link Lo is set at this step S21, processing will always be advanced to S28 from latter Step S27.

[0065]Then, like Steps S1-S5 of a 1st embodiment, map data is read, the present link Ln is specified, Ln is compared with Lo, and renewal of mileage memory and the update process of run frequency memory are performed (Steps S22-S26). The storage configuration of the total mileage for every road scale memorized on the history storage part 3 and the run frequency for every link is the same as that of a 1st embodiment.

[0066]Then, the separation unification judgment part 402 judges whether it can be considered that is a trunk road, or it applies to a trunk road about each of the link Lo and the present link Ln last time since run frequency is high even if it is not a trunk road (Steps S27-S29).

[0067]Here, a judgment of being a trunk road is made like Step S6 in a 1st embodiment based on the total mileage for every road scale memorized on the history storage part 3. Or I hear that it is determined based on the memory concerned and judged in accordance with the decision criterion held to another field, and it may be. Even if it is a case where it is judged that it is not a trunk road, if run frequency is high, it will be regarded as the road according to a trunk road, and the following processings will be advanced.

[0068]For this reason, with reference to the run frequency for every road link memorized on the history storage part 3, it is investigated last time like Step S8 in a 1st embodiment whether the frequency of the link Lo and the present link Ln is more than N. In the following description, that run frequency is beyond the constant value N, and consider that applies to a trunk road is also summarized, and explanation is simplified by calling it a "trunk road." The other road will be called a "small-scale road" to this.

[0069]By the judging process of Steps S27-S29, the following four kinds of cases are materialized and different processing according to each is performed. Namely, when ** Lo and Ln are trunk roads (it branches to YES also by YES and Step S28 at Step S27)

** When Lo is a trunk road and Ln is a small-scale road (it branches to YES at Step S27, and branches to NO at Step S28)

** When Lo and Ln are small-scale roads (it branches to NO at Step S27, and branches to YES at Step S29)

** When Lo is a small-scale road and Ln is a trunk road (it branches to NO also by NO and Step S29 at Step S27)

It comes out. Hereafter, the processing which continues at it in each case is explained.

[0070]Probably, in **, since self-vehicles continue a trunk road and are running, memory processing is not needed about a course. Then, like Step S7 in a 1st embodiment, if necessary, processing which updates the standard of a road scale of being used for judgment of a trunk road will be performed (Step S30).

[0071]** Since I hear that self-vehicles branched on the small-scale road and there are in a case from a trunk road, start henceforth the processing which summarizes all the continuous small-scale road

links, and is memorized as one distance. Then, the running-locus Management Department 403 seoures the field for memorizing the running locus of the part of about one line on the history storage part 3 first (Step S31). Hereafter, the field which memorizes this distance (course of a small-scale road of reaching [from the turning point from a trunk road] a juncture) memorized or this will be referred to by "Ri."
[0072]The storage area of Ri shall be secured with a gestalt as shown in drawing 11, for example. That is, each distance Ri, Ri+1, and — hold each road link which constitutes it, and its number of links. Since the number of links is variable length, it holds the pointer to a link storage area actually, for example. In the field Rl, it is assumed that the frequency which ran the course is held apart from the run frequency of each road link as shown in drawing 5. The coordinates of the point which advances into the distance Ri if needed (Xi, Yi), Or the coordinates of the representative point in the case of representing the coordinates (Xo, Yo) of the point to leave, and the position of the whole distance Ri with one point (Xr, Yr), As long as Ri and the trunk road to run parallel to are able to describe by data like a structure furthermore, the identifier or pointer may be held as attendant information.
[0073]Such a storage area Ri is secured at Step S31, since it advances into this distance Ri for the first time, the number of links is reset to 0, and if required, the information which has become clear at those times, such as an entry point, is written in. Then, the present link Ln which is the first composition link is memorized to the composition link storage area which Ri shows, and the number of links is **********ed one time (Step S32). And the memory processing of the field Ri is still continuing now, and it does not end, but the flag (under continuation of memory processing flag) which shows that a still newer composition link may be added to the field Ri from now on is set (Step S33).
[0074]** Since self-vehicles continue a small-scale road and are running, a composition link must be further added to a case to the storage area Ri under continuation of memory processing now. Then, after adding the present link Ln (It is the present link newly detected at Step S23 before starting this processing) to the distance of the field Ri, the number of links is **********ed one time and a flag is maintained by a set state during continuation of memory processing (Step S32, S33).
[0075]** Since I hear that self-vehicles joined the trunk road again and there are in a oase from a small-scale road, perform post-processing for ending this to the field Ri under continuation of memory processing now. Then, first, in the end of memory of the field Ri, if necessary, this will be written in in quest of attendant information, such as a leaving point (Step S34). Then, it is investigated whether the course Rj which the running-locus Management Department 403 can identify with the distance memorized in the storage area Ri is already memorized on the history storage part 3 (Step S35).
[0076]This is for avoiding overlapping and memorizing the same course, and is equivalent to processing of Step S11 in a 1st embodiment. However, although what was necessary was just in the case of Step S11 of a 1st embodiment to have investigated whether two links would be the same since the storage-and-file-management object was a link simple substance, If all the composition links make it a decision criterion whether to be thoroughly in agreement, sense of incongruity may be made to hold for a user, since it is aimed at the course which is accumulation of two or more links in the case of a 2nd embodiment. For example, as shown in drawing 12 (A), the two courses Ri and Rj are constituted from the same link by the most, but. When it is a link with which only parts differ, it is a case as shown in the figure (B), while as another side is included, and is a case so that it may be small except an inclusion portion as compared with the whole etc. It is investigated whether also including such a case, the distance Ri and similarity are high and the course it can consider that is the same substantially is already memorized. If it seems that procedure becomes complicated by such a similar judging process, in order to raise processing speed, identity can also be judged by whether all the composition links are simply in agreement.
[0077]Since Rl is a new distance if the course which is similar by the judging process of a similar course is not found, this is memorized on the history storage part 3, and frequency is set to 1 (Step S36).
[0078]Conversely, if the already memorized similar course Rj is found, in order not to leave memory of Ri as a current line, this will be eliminated, and, on the other hand, the run frequency will be **********ed one time about the course Rj in which it has registered (Step S37). The method of eliminating memory of the course Rj in which it has registered, and memorizing Ri as substitution processing of this processing as a new current line, and setting and memorizing the run frequency+1 of Rj in that run frequency can also be taken. Although Ri includes Rj, when the big ratio is occupied also except the inclusion portion, difference with Rj is set to Ri about Ri, the frequency may be set to 1,

memory may be become final and conclusive, and, on the other hand, it may decide to ********** run frequency also about Rj.
[0079]anyway, memory — the memory being eliminated about an unnecessary course, and, if it becomes more than the value N as which the frequency was beforehand determined to the course Rj which **********ed frequency In the preceding paragraph, for example, a course, This course is regarded as the user already remembering at and not having the necessity for a course guidance, and eliminates memory of still such a course Rj from on the history storage part 3 (Step S38).
[0080]In this **, since the necessity for memory of a running locus is lost as long as it runs a trunk road henceforth, since it is a case where the present link Ln joins a trunk road, the flag under continuation of memory processing is once reset at the continuing step (Step S39).
[0081]As mentioned above, after [each / from which the last link Lo and the present link Ln were divided into four kinds according to the trunk road or the small-scale road] processing course memory etc. about a case, it shifts to processing not more than step S40. In Step S24, also when the link Lo and the present link Ln are last time the same, processing is moved here.
[0082]In Step S40, it is checked whether the command of power OFF, all the processing stops, etc. is issued to the system. According to this 2nd embodiment, when a power supply is temporarily made into the ceresin during the continuation of memory processing of a running locus, after performing post-processing for ending about the course under memory, it must stop. Then, it is considered as the system of composition even if it turns off the electric power switch for example, so that processing may not immediately be suspended, and if the switch is turned off, the flag which shows that the cease and desist order was issued will be set. And if this flag is checked for every repetition processing at each time (Step S40) and the cease and desist order is issued as a result, the flag of whether the memory processing of a running locus is continuing further will be investigated (Step S41). And if memory processing is continuing, a series of procedure for returning to processing of Step S34 and ending memory processing will be performed. Since the reset processing of the flag which shows under the continuation of processing of Step S39 is also included in this, if it performs once, a loop will not be again carried out to Step S34 from Step S41.
[0083]If required processing is ended about a power supply cease and desist order, the drawing processing part 406 will perform drawing processing of map data and route display processing (Step S42). This is the same as that of processing of Step S13 of a 1st embodiment. However, if the attendant information of a representative point, the point leaving [penetration /], a parallel running way, etc. is described by the memorized running locus, When self-vehicles approach the course concerned when displaying a running locus and the terminal point of the course concerned is approached especially, it can also control to display only within the case where the parallel running trunk road of the course concerned is arrived at etc.
[0084]After setting the present link Ln to the link Lo last time following map drawing and route display processing for the next repetition processing (Step S43), It checks whether the above processing is repeated, in repeating, it continues processing from Step S22, and it ends this processing, in not repeating, it will shift to execution of other processings and it will be suited, and ** will suspend a system, if the cease and desist order has come out (Step S44).
[0085]In the navigation system of this 2nd embodiment. Since it is expected like a 1st embodiment that the user remembers well a major arterial road like a speed way and a national highway, the necessity of carrying out a course guidance is low, but since it is hard for a user to memorize the small-scale road where run frequency is low, If it runs the course, it can use for the course guidance at the time of a next run by memorizing a running locus automatically. If run frequency becomes high even if it is a small-scale road, even if it will make a storage capacity small by assuming that the user memorized the course and deleting from running-locus memory, a course guidance can be received about a course very required for a user.
[0086]In addition, as shown in the left of drawing 13, supposing it runs course Rs2 which runs course Rs1 in which a user bypasses trunk road Rm1 at a certain time, and bypasses trunk road Rm2 at a certain time, both will be remembered as a running locus and will be displayed. And it runs each of these courses several times, and if frequency exceeds N, about the course, it will be eliminated from a display.

[0087]Supposing it carried out also here and a part of course Rs1 and Rs2 comprised a common road

link, If storage and file management of the course is independently performed for each link of every like a 1st embodiment, Since frequency will reach N ahead of other portions about the link part in which two courses are common, a route display will be carried out after the link part which is common as shown in the right of drawing 13 has suffered a loss. In this case, the link group left behind in here has lost the meaning of the course which bypasses each original trunk road, and it may also become inviting there being not only no meaning which dares to display this but a user's misunderstanding. However, since such course Rs1 and Rs2 are memorized and deleted with all the links which constitute each according to a 2nd embodiment, Though one frequency reaches N previously, and the course was deleted from memory and is no longer displayed, it will be left behind holding the meaning as an original alternate route in the course of another side, an unnatural route display which is not suitable to user feeling can be avoided, and practicality is high.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram showing the functional constitution of a 1st embodiment of this invention.
[Drawing 2]The flow chart (1) of operation of the above-mentioned embodiment.
[Drawing 3]The flow chart (2) of operation of the above-mentioned embodiment.
[Drawing 4]The explanatory view of the total traveled distance data which the history storage part in the above-mentioned embodiment has memorized.
[Drawing 5]The explanatory view of the run frequency data for every road link which the history storage part in the above-mentioned embodiment has memorized.
[Drawing 6]The explanatory view of the running track data which the history storage part in the above-mentioned embodiment has memorized.
[Drawing 7]The explanatory view showing the example of a route display by the above-mentioned embodiment.
[Drawing 8]The flow chart (1) of operation of a 2nd embodiment of this invention.
[Drawing 9]The flow chart (2) of operation of the above-mentioned embodiment.
[Drawing 10]The flow chart (3) of operation of the above-mentioned embodiment.
[Drawing 11]The explanatory view of the running track data which the history storage part in the above-mentioned embodiment has memorized.
[Drawing 12]The explanatory view showing the example of the course it can be considered that is the same course in the similar decision processing of the running path by the above-mentioned embodiment.

[Drawing 13]The explanatory view showing the feature of the course memory by the above-mentioned embodiment.
[Description of Notations]
1 Current position primary detecting element
2 Map data storing section
3 History storage part
4 Arithmetic processing section
5 Picture display part
401 Current position collating part
402 Branching unification judgment part
403 Running-locus Management Department
404 Road scale Management Department
405 Run frequency Management Department
406 Drawing processing part

[Translation done.]

DRAWINGS

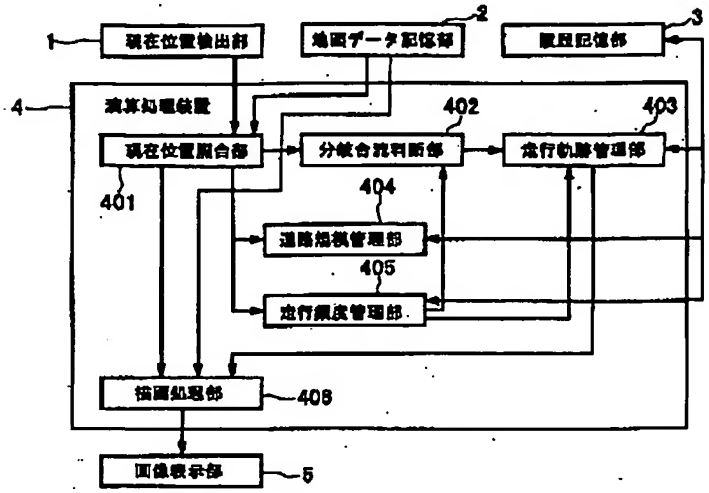
[Drawing 4]

道路種別	距離(km)	比率	道路幅員	距離(km)	比率
高速道	6548.14	25.8%	10m以上	7662.53	30.2%
国道	5708.64	22.5%	6m以上～10m未満	7538.87	29.7%
主要地方道	4668.58	18.4%	3m以上～6m未満	5810.33	22.9%
一般都道府県道	3186.66	12.6%	3m未満	4364.09	17.2%
一般市道	2396.68	9.3%			
幅街路	2892.48	11.4%			
総走行距離	25372.62		総走行距離	25372.62	

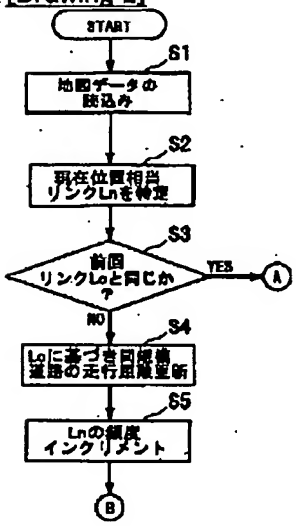
[Drawing 5]

リンク識別子	幅員
000001	0
000002	1
000003	0
...	...
...	...
012042	21
012043	7
...	...
...	...

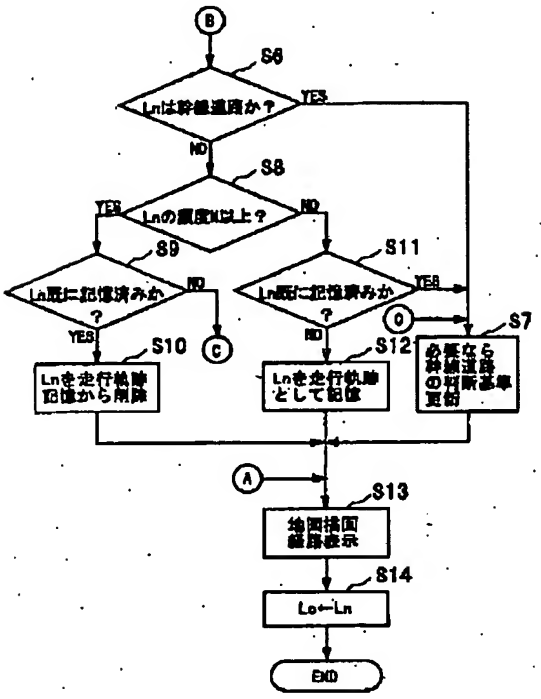
[Drawing 1]



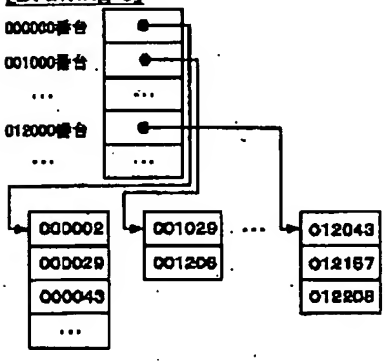
[Drawing 2]



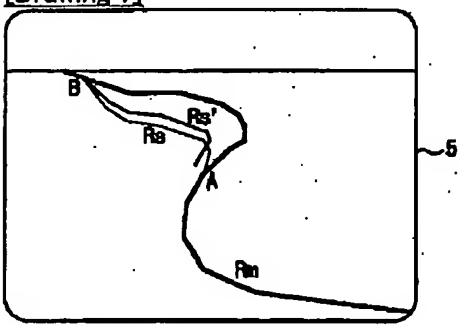
[Drawing 3]



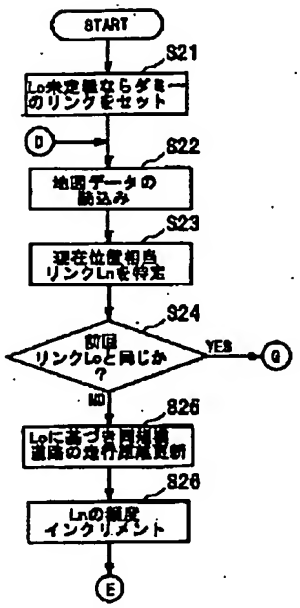
[Drawing 6]



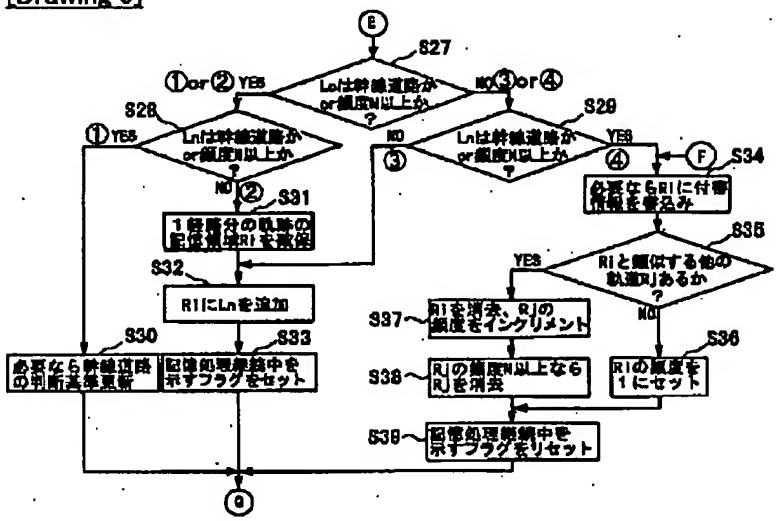
[Drawing 7]



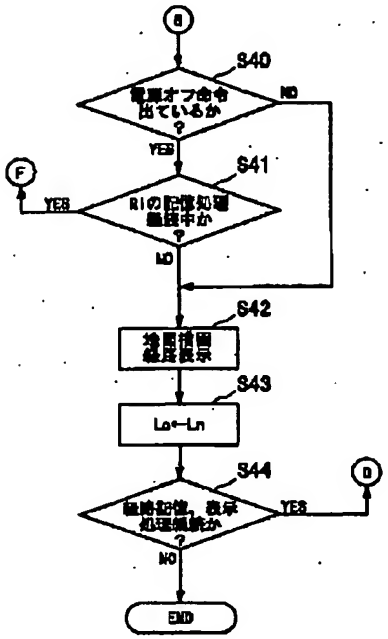
[Drawing 8]



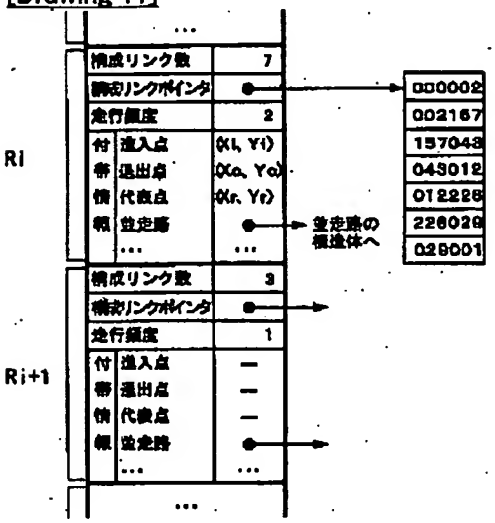
[Drawing 9]



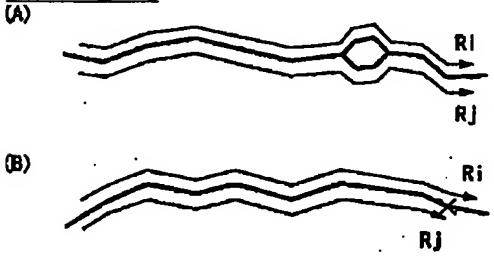
[Drawing 10]



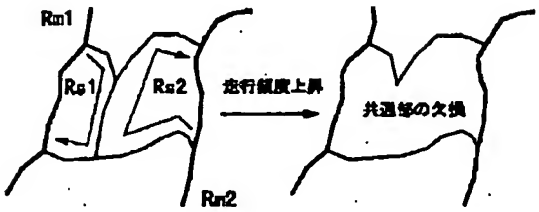
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Translation done.]

(19)日本国特許庁（JP）　(12)公開特許公報（A）　(11)特許出願公開番号

特開平11－148833

(43)公開日　平成11年(1999)6月2日

(51)Int.Cl.⁶	識別記号	FI	
G01C 21/00		C01C 21/00	G
			B
G08G 1/0969		C08G 1/0969	
G09B 29/10		C09B 29/10	A

審査請求　未請求　請求項の数11　OL　（全 14 頁）

(21)出願番号　特願平9－313841

(22)出願日　平成9年(1997)11月14日

(71)出願人　000003997
日産自動車株式会社
神奈川県横浜市神奈川区宝町２番地

(72)発明者　渡部　成幸
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

(72)発明者　斎藤　浩
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

(72)発明者　大野　健
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

(74)代理人　弁理士　三好　秀和　（外８名）

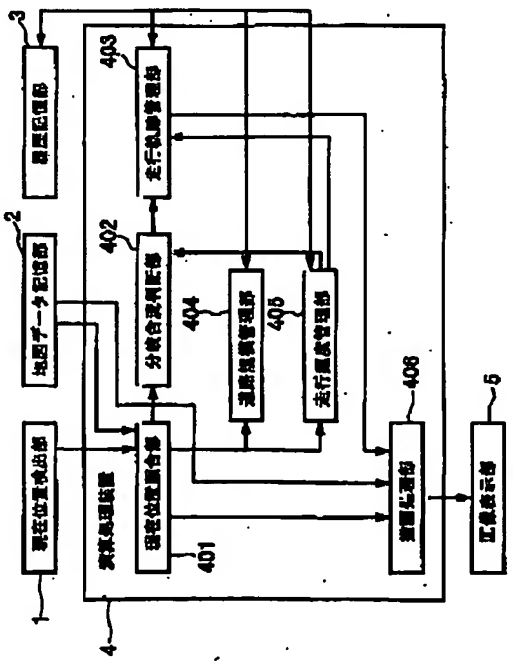
最終頁に続く

(54)【発明の名称】　ナビゲーションシステム

(57)【要約】

【課題】　ユーザになじみの薄い経路を自動的に記憶し、経路誘導で表示する。

【解決手段】　このナビゲーションシステムは、現在位置照合部401 が自車両の現在位置を地図データ記憶部２から読み出した地図データ上での現在位置と照合し、分岐合流判断部402 が現時点で照合された現在位置と一時点前に照合された現在位置とを比較して、自車両があらかじめ定められた規模以上の幹線道路から分岐したか、あるいはこれに合流したかを判断する。この判断結果にしたがい、走行軌跡管理部404 が幹線道路からの分岐から再合流まで変化する一連の現在位置を走行軌跡として履歴記憶部３に記憶する。そして描画処理部406 が現時点の現在位置にしたがって表示する地図領域を決定し、現在位置照合部401 の読み出した地図データに基づいて地図画像を地図表示部５に描画し、履歴記憶部３に記憶された走行軌跡の一部又は全部をこの地図画像上に識別できる形で表示する。



【特許請求の範囲】
【請求項1】 車両の現在位置を測位する現在位置検出手段と、地図データを記憶する地図データ記憶手段と、走行履歴を更新可能な形で記憶する履歴記憶手段と、地図表示に必要な演算処理を行う演算処理手段と、地図画像を表示する画像表示手段とを備えて成るナビゲーションシステムであって、
前記演算処理手段は、前記現在位置検出手段の出力に基づいて前記地図データ記憶手段から読み出した地図データ上での現在位置を照合する現在位置照合手段と、この照合された現在位置と一時点前に照合された現在位置とを比較し、走行車両があらかじめ定められた規模以上の幹線道路から分岐したか、あるいはこれに合流したかを判断する分岐合流判断手段と、この分岐合流の判断結果にしたがって分岐から合流に至るまで変化する一連の現在位置を走行軌跡として前記履歴記憶手段に記憶する走行軌跡管理手段と、現時点の現在位置にしたがって表示する地図領域を決定し、前記現在位置照合手段の読み出した地図データに基づいて地図画像を描画し、前記履歴記憶手段に記憶された走行軌跡の一部又は全部をこの地図画像に識別できる形で表示する描画処理手段とを有することを特徴とするナビゲーションシステム。
【請求項2】 請求項1に記載のナビゲーションシステムにおいて、前記演算処理手段は、道路規模ごとの延べ走行距離若しくはその比率を前記履歴記憶手段に記憶する道路規模管理手段を有し、前記分岐合流判断手段は、前記分岐合流の判断基準となる幹線道路の定義を当該道路規模ごとの走行比率に基づいて設定することを特徴とするナビゲーションシステム。
【請求項3】 前記道路規模管理手段は、あらかじめ定められた区分領域ごとに道路規模ごとの延べ走行距離若しくはその比率を前記履歴記憶手段に記憶し、前記分岐合流判断手段は、前記分岐合流の判断基準となる幹線道路の定義を前記区分領域ごとに独立に定め、この道路規模ごとの走行比率に基づいて設定することを特徴とする請求項2に記載のナビゲーションシステム。
【請求項4】 請求項1～3のいずれかに記載のナビゲーションシステムにおいて、前記演算処理手段は、道路ごとの走行頻度を前記履歴記憶手段に記憶する走行頻度管理手段を有し、前記分岐合流判断手段は、前記幹線道路に該当しない道路であってもその走行頻度が所定値以上に高ければ幹線道路と見なして前記分岐合流の判断基準に用いることを特徴とするナビゲーションシステム。
【請求項5】 前記走行軌跡管理手段は、前記履歴記憶手段に記憶されている前記走行頻度を参照し、当該履歴記憶手段にいったん記憶した走行軌跡に対してその走行頻度が所定値以上になれば当該走行軌跡の記憶を削除することを特徴とする請求項4に記載のナビゲーションシステム。
【請求項6】 前記走行軌跡の記憶、頻度記憶又は記憶削除を、前記走行軌跡を構成する道路リンク単位で行うことを特徴とする請求項1～5のいずれかに記載のナビゲーションシステム。
【請求項7】 前記走行軌跡の記憶、頻度記憶又は記憶削除を、前記幹線道路からの分岐点から前記幹線道路への再合流点までを1経路とし、当該経路単位で行うことを特徴とする請求項1～5のいずれかに記載のナビゲーションシステム。
【請求項8】 前記描画処理手段は、車両の現在位置が前記履歴記憶手段に記憶された前記走行軌跡のいずれかに接近した場合、当該走行軌跡のいずれかの終端点に接近した場合又は前記走行軌跡のいずれかと並走する前記幹線道路における当該並走区間に到達した場合に、該当する走行軌跡の1つを地図画像上に識別できる形で表示することを特徴とする請求項1～7のいずれかに記載のナビゲーションシステム。
【請求項9】 前記描画処理手段は、前記履歴記憶手段に記憶された前記走行軌跡のうち、車両の現在位置に近い特定の領域に存在する走行軌跡のすべてを地図画像上に識別できる形で表示することを特徴とする請求項1～7のいずれかに記載のナビゲーションシステム。
【請求項10】 前記描画処理手段は、前記現在位置照合手段の読み出した地図データに基づいて地図画像を描画する際に、前記走行軌跡を当該地図画像データ中に含まれていない道路であっても該当する位置に強制的に表示することを特徴とする請求項1～9のいずれかに記載のナビゲーションシステム。
【請求項11】 前記描画処理手段は、前記地図画像上に前記走行軌跡をその本来の道路規模よりも上位の道路規模に与えられている表示属性に変更して表示することを特徴とする請求項1～10のいずれかに記載のナビゲーションシステム。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は、車両の現在位置を地図画像と共に表示して経路誘導などの用途に供するナビゲーションシステムにおいて、特に、走行経路を自動的に記憶し、表示する機能を有するナビゲーションシステムに関する。
【0002】
【従来の技術】従来のナビゲーションシステムとして、車両の時々刻々の現在位置を点列データとして記憶し、走行軌跡として表示する機能を有するものが数多くある。このようなナビゲーションシステムにあっては、無条件にすべての位置データを記憶していくが、記憶容量の制約から一定のデータ量を超えると過去のデータから順次削除していく構成にしていたため、必ずしもユーザの確認したい経路が常時記憶されていて、必要に応じて参照できるというものではなかった。
【0003】これを解決するために、特開平6-300

５７７号公報に開示された「走行軌跡表示装置」にあっては、ユーザの要求入力によって所望の走行軌跡を現在の走行軌跡とは別の記憶装置に保存することが記載されている。

【０００４】

【発明が解決しようとする課題】しかしながら、この従来例では、ユーザの入力操作を走行軌跡記憶の契機としているため、ユーザの経路記憶要求を完全に満足できる利点がある反面、逐一、ユーザが操作しなければならない煩わしさが残されており、特にこの走行軌跡記憶の操作が階層型メニューを辿るようなインタフェースによって実現されている場合には、運行の安全上、その都度、車両を停車させて操作しなければならない煩わしさがあった。また、ユーザが記録要求の入力操作を忘れれば、必要とする走行軌跡が記憶されない問題点もあった。

【０００５】ところで、ユーザが過去に走行した経路の中で、利便性の大きな経路が単純で覚えやすいものであればシステムが自動記憶する必要性は低いと考えられ、ユーザにとって覚えにくい経路を自動的に記憶し、経路誘導に反映することが望まれる。すなわち、道路規模が小さくて複雑であれば、またその地域を走行する頻度が低ければ、ユーザ自身がそのような経路を記憶していることは困難であると想定されるので、このような経路についてシステム側で自動的に識別して記憶していくことが望まれる。また、道路規模が小さくて複雑であっても、走行頻度がある程度高くなれば、そのような経路はユーザが繰り返し通行していることになるので、ユーザがすでに記憶していて経路誘導をする必要性はなくなると想定することができ、いったん記憶した走行経路であっても、このような経路については記憶から削除することによって限りあるメモリを有効に活用することができる。

【０００６】本発明は、このような従来の問題点に鑑みてなされたもので、ユーザの本質的な経路記憶要求をある程度反映する客観的基準を契機として走行軌跡記憶の開始、終了を自動的に行うことにより、ユーザに走行軌跡の記憶要求操作を要求することなく、かつユーザの運転特性に応じて記憶を必要とする蓋然性が高い走行軌跡について自動的に記憶し、経路誘導に利用することができるナビゲーションシステムを提供することを目的とする。

【０００７】

【課題を解決するための手段】請求項１の発明は、車両の現在位置を測位する現在位置検出手段と、地図データを記憶する地図データ記憶手段と、走行履歴を更新可能な形で記憶する履歴記憶手段と、地図表示に必要な演算処理を行う演算処理手段と、地図画像を表示する画像表示手段とを備えて成るナビゲーションシステムであって、前記演算処理手段が前記現在位置検出手段の出力に基づいて前記地図データ記憶手段から読み出した地図データ上での現在位置を照合する現在位置照合手段と、この照合された現在位置と一時点前に照合された現在位置とを比較し、走行車両があらかじめ定められた規模以上の幹線道路から分岐したか、あるいはこれに合流したかを判断する分岐合流判断手段と、この分岐合流の判断結果にしたがって分岐から合流に至るまで変化する一連の現在位置を走行軌跡として前記履歴記憶手段に記憶する走行軌跡管理手段と、現時点の現在位置にしたがって表示する地図領域を決定し、前記現在位置照合手段の読み出した地図データに基づいて地図画像を描画し、前記履歴記憶手段に記憶された走行軌跡の一部又は全部をこの地図画像に識別できる形で表示する描画処理手段とを有するものである。

【０００８】請求項１の発明のナビゲーションシステムでは、現在位置検出手段によって自車両の現在位置を周期的に検出し、現在位置照合手段によってこの現在位置を地図データ記憶手段から読み出した地図データ上での現在位置と照合する。そして分岐合流判断手段により、現時点で照合された現在位置と一時点前に照合された現在位置とを比較して、自車両があらかじめ定められた規模以上の幹線道路から分岐したか、あるいはこれに合流したかを判断し、この分岐合流の判断結果にしたがい、走行軌跡管理手段が幹線道路からの分岐から幹線道路への再合流に至るまで変化する一連の現在位置を走行軌跡として履歴記憶手段に記憶する。そして描画処理手段により、現時点の現在位置にしたがって表示する地図領域を決定し、現在位置照合手段の読み出した地図データに基づいて地図画像を地図表示手段に描画し、履歴記憶手段に記憶された走行軌跡の一部又は全部をこの地図画像上に識別できる形で表示する。

【０００９】これによって、ユーザが走行経路として覚えにくい非幹線道路を走行した場合にその経路を自動的に記憶していき、経路誘導表示の際に自車両の現在位置に対応して、ユーザになじみがなく、それゆえに表示の必要性の高い経路を地図画像と共に表示することができる。

【００１０】請求項２の発明は、請求項１に記載のナビゲーションシステムにおいて、前記演算処理手段が道路規模ごとの延べ走行距離若しくはその比率を前記履歴記憶手段に記憶する道路規模管理手段を有し、前記分岐合流判断手段が前記分岐合流の判断基準となる幹線道路の定義を当該道路規模ごとの走行比率に基づいて設定するようにしたものであり、幹線道路の定義を高速道、国道、地方道など走行した道路の走行距離を道路規模ごとにその延べ走行距離を記憶していき、全走行距離に対する各道路規模ごとの延べ走行距離の比率に基づき、走行比率の低い小規模道路を非幹線道路としてその経路だけを記憶する。

【００１１】これによって、ユーザの走行特性に応じて、頻繁に走行する道路であれば非主要道路でなくても

走行比率が上昇するので幹線道路とみなし、そのような経路はユーザにあえて経路表示しないようにし、ユーザにとってなじみの少ない経路についてのみ走行軌跡を記憶し、経路誘導のために表示する。

【0012】請求項3の発明は、請求項2のナビゲーションシステムにおいて、前記道路規模管理手段があらかじめ定められた区分領域ごとに道路規模ごとの延べ走行距離若しくはその比率を前記履歴記憶手段に記憶し、前記分岐合流判断手段が前記分岐合流の判断基準となる幹線道路の定義を前記区分領域ごとに独立に定め、この道路規模ごとの走行比率に基づいて設定するようにしたものであり、ユーザの日常的に走行する区域と遠出の際に走行する区域とでは走行した道路の規模が同じであってもユーザの記憶には大きな違いが出るので、日常的に走行する区域とそれ以外の区域とで区分領域ごとに幹線道路の定義を独立して定めることにより、ユーザの生活地域でも遠方の地域でもユーザにとってなじみの少ない経路についてのみ走行軌跡を記憶し、経路誘導のために表示するようにする。

【0013】請求項4の発明は、請求項1～3のいずれかに記載のナビゲーションシステムにおいて、前記演算処理手段が道路ごとの走行頻度を前記履歴記憶手段に記憶する走行頻度管理手段を有し、前記分岐合流判断手段が前記幹線道路に該当しない道路であってもその走行頻度が所定値以上に高ければ幹線道路と見なして前記分岐合流の判断基準に用いるようにしたものであり、道路規模が小さくてもユーザが何回も走行しており、積極的に記憶して次回走行時に参照しようとする可能性が低いと予想される経路については、これを記憶しないことによって記憶量を節約し、かつ記憶経路を表示する際に不要な経路を表示しないことにより煩雑さを避ける。

【0014】請求項5の発明は、請求項4の記載のナビゲーションシステムにおいて、前記走行軌跡管理手段が前記履歴記憶手段に記憶されている前記走行頻度を参照し、当該履歴記憶手段にいったん記憶した走行軌跡に対してその走行頻度が所定値以上になれば当該走行軌跡の記憶を削除するようにしたものであり、いったん記憶した経路であっても何回か走行することによってユーザが覚えたと想定されるように経路については、記憶から削除することによって走行軌跡の記憶量を節約し、また記憶経路を表示する際に不要な経路を表示しないことにより煩雑さを避ける。

【0015】請求項6の発明は、請求項1～5のナビゲーションシステムにおいて、前記走行軌跡の記憶、頻度記憶又は記憶削除を、前記走行軌跡を構成する道路リンク単位で行うものであり、道路データを構成する最小基本単位で一律に経路の記憶管理ができ、各演算処理が簡易となって処理速度の向上が望める。

【0016】請求項7の発明は、請求項1～5のナビゲーションシステムにおいて、前記走行軌跡の記憶、頻度記憶又は記憶削除を、前記幹線道路からの分岐点から前記幹線道路への再合流点までを1経路とし、当該経路単位で行うものであり、迂回路として別経路であっても共通する道路リンクを包含するような経路について、道路リンク単位で記憶管理していれば延べ走行距離の比率が上昇し、走行頻度が高くなって幹線道路に定義され、経路表示の際に非表示となり、あるいは記憶から削除されるような道路リンクについても経路全体として走行頻度が低ければ経路の一部として表示されることになり、ユーザの感覚に即した経路表示が可能となる。

【0017】請求項8の発明は、請求項1～7のナビゲーションシステムにおいて、前記描画処理手段が車両の現在位置が前記履歴記憶手段に記憶された前記走行軌跡のいずれかに接近した場合、当該走行軌跡のいずれかの終端点に接近した場合又は前記走行軌跡のいずれかと並走する前記幹線道路における当該並走区間に到達した場合に、該当する走行軌跡の1つを地図画像上に識別できる形で表示するようにしたものであり、ユーザが参照する必要性が高いと予想される場合に限って必要な経路のみを表示することができ、表示の煩雑さを避けることができる。

【0018】請求項9の発明は、請求項1～7のナビゲーションシステムにおいて、前記描画処理手段が前記履歴記憶手段に記憶された前記走行軌跡のうち、車両の現在位置に近い特定の領域に存在する走行軌跡のすべてを地図画像上に識別できる形で表示するようにしたものであり、自車両と各走行軌跡との距離を計算するなどの複雑な演算処理を行うことなく、自車両位置の近くにあり、したがって参照する必要性の高い経路のみを表示することができる。

【0019】請求項10の発明は、請求項1～9のナビゲーションシステムにおいて、前記描画処理手段が前記現在位置照合手段の読み出した地図データに基づいて地図画像を描画する際に、前記走行軌跡を当該地図画像データ中に含まれていない道路であっても該当する位置に強制的に表示するようにしたものであり、例えば、地図表示モードが自車両走行中であったり広域表示であったりするために当該走行軌跡と同等以下の小規模道路が本来であれば表示されない場合であっても、これを表示するようにすることによりユーザにとって参照する必要性の高い経路を常に表示する。

【0020】請求項11の発明は、請求項1～10のナビゲーションシステムにおいて、前記描画処理手段が前記地図画像上に前記走行軌跡をその本来の道路規模よりも上位の道路規模に与えられている表示属性に変更して表示するようにしたものであり、道路地図表示としてユーザに理解しやすい表示が可能である。

【0021】

【発明の効果】請求項1の発明によれば、ユーザが走行経路として覚えにくい非幹線道路を走行した場合にその

経路を自動的に記憶していき、経路誘導表示の際に自車両の現在位置に対応して、ユーザになじみがなく、それゆえに表示の必要性の高い経路を地図画像と共に表示することができる。

【0022】請求項2の発明によれば、ユーザの走行特性に応じて、頻繁に走行する道路であれば非主要道路でなくても走行比率が上昇するので幹線道路とみなし、そのような経路はユーザにあえて経路表示しないようにし、ユーザにとってなじみの少ない経路についてのみ走行軌跡を記憶し、経路誘導のために表示することができる。

【0023】請求項3の発明によれば、ユーザが日常的に走行する区域とそれ以外の区域とで区分領域ごとに幹線道路の定義を独立して定めることにより、ユーザの生活地域でも遠方の地域でもユーザにとってなじみの少ない経路についてのみ走行軌跡を記憶し、経路誘導のために表示することができる。

【0024】請求項4の発明によれば、道路規模が小さくてもユーザが何回も走行しており、積極的に記憶して次回走行時に参照しようとする可能性が低いと予想される経路は記憶しないことによって記憶量を節約し、かつ記憶経路を表示する際に不要な経路を表示しないことにより煩雑さを避けることができる。

【0025】請求項5の発明によれば、いったん記憶した経路であっても何回か走行することによってユーザが覚えていると想定されるように経路については、記憶から削除することによって走行軌跡の記憶量を節約し、また記憶経路を表示する際に不要な経路を表示しないことにより煩雑さを避けることができる。

【0026】請求項6の発明によれば、道路データを構成する最小基本単位で一律に経路の記憶管理ができ、各演算処理が簡易となって処理速度が向上できる。

【0027】請求項7の発明によれば、迂回路として別経路であっても共通する道路リンクを包含するような経路について、道路リンク単位で記憶管理していれば延べ走行距離の比率が上昇し、走行頻度が高くなって幹線道路として定義され、経路表示の際に非表示となり、あるいは記憶から削除されるような道路リンクについても経路全体として走行頻度が低ければ経路の一部として表示することができ、ユーザの感覚に即した経路表示が可能である。

【0028】請求項8の発明によれば、ユーザが参照する必要性が高いと予想される場合に限って必要な経路のみを表示することができ、表示の煩雑さを避けることができる。

【0029】請求項9の発明によれば、自車両と各走行軌跡との距離を計算するなどの複雑な演算処理を行うことなく、自車両位置の近くにあり、したがって参照する必要性の高い経路のみを表示することができる。

【0030】請求項10の発明によれば、地図表示モードにより、本来であれば表示されない小規模道路に属する走行経路であってもこれを表示することによって、ユーザにとって参照する必要性の高い経路を常に表示することができる。

【0031】請求項11の発明によれば、地図画像上に走行軌跡をその本来の道路規模よりも上位の道路規模に与えられている表示属性に変更して表示するので、道路地図表示としてユーザに理解しやすい表示が可能である。

【0032】

【発明の実施の形態】以下、本発明の実施の形態を図に基づいて詳説する。図1は本発明の第1の実施の形態のナビゲーションシステムの処理機能の構成を示しており、この実施の形態のナビゲーションシステムは、車両の現在位置を測位する現在位置検出部1と、地図データを記憶する地図データ記憶部2と、軌跡、走行距離、走行頻度などの走行履歴を更新可能な形で記憶する履歴記憶部3と、地図表示に必要な演算処理を行う演算処理装置4と、地図画像を表示する画像表示部5から構成されている。

【0033】現在位置検出部1は、GPSや車速センサ、ジャイロセンサなどにより走行車両の現在位置を、例えば、緯度・経度などの形式で計測して出力する。地図データ記憶部2と履歴記憶部3は、CDやDVD、フラッシュメモリなどの記憶媒体であって、構成上一体であってもよいが、少なくとも履歴記憶については書込みや削除といった記憶内容の更新が可能でなければならない。演算処理装置4は、CPU、内部メモリなどから成るコンピュータであり、各種処理をプログラムの形で記憶し、実行する。画像表示部5は、液晶モニタやCRTなどの表示装置である。

【0034】さらに、演算処理装置4を機能別に分割して示すと、現在位置検出部1の出力に基づき、マップマッチングなどの手法を用いて車両の現在位置を地図データ上で照合し、特定する現在位置照合部401、照合された現在位置を一時点前に照合された現在位置と比較して、走行車両が定められた規模以上の道路（幹線道路）から分岐したか、あるいはそれに合流したかを判断する分岐合流判断部402、分岐合流判断部402の判断結果にしたがって分岐から合流に至る一連の現在位置を走行軌跡として履歴記憶部3に記憶し、あるいは必要に応じてこれを削除する走行軌跡管理部403、道路規模ごとの延べ走行距離若しくはその比率を履歴記憶部3に記憶する道路規模管理部404、道路ごとの走行頻度を履歴記憶部3に記憶する走行頻度管理部405、車両の現在位置から表示する地図領域を決定し、必要な地図データを用いて地図画像を描画し、さらに所定の走行軌跡を表示する描画処理部406から構成されている。

【0035】なお、後述する幹線道路判断基準の変更処理、走行頻度による走行軌跡の記憶管理処理を行わない